Using the Washington State ShoreZone Inventory For Shoreline Planning

Helen Berry

DNR Nearshore Habitat Program

WASHINGTON STATE DEPARTMENT OF Natural Resources
Doug Sutherland - Commissioner of Public Lands

PSAMP Puget Sound Ambient Monitoring Program

Presentation Overview

1. Overview of ShoreZone Inventory - data collection methods and data structure

2. Introduction to shape files and associated tabular data

3. Examples of ShoreZone results and planning applications

Washington ShoreZone Inventory Project Overview

- Statewide inventory of saltwater shorelines (~3000 miles)
- Describes physical and biological habitat attributes
- Data and documentation: www2.wadnr.gov/nearshore/

In Feb. 2001, DNR released a statewide GIS inventory of saltwater habitats, called the Washington State SZ inventory. It describes more than 3000 miles of marine shoreline. The data was collected between 1994-2000.

The inventory categorizes features along the shoreline including physical features (like beach type and substrate), biological features - like kelp & eelgrass, as well as more obvious sessile invertebrate types, like sand dollars), AND anthropogenic features, such as shoreline modification, piers, and boat ramps.

Demand for this data set has been overwhelming. Interested parties range widely, including all levels of government agencies, tribes, NGOs, researchers and educators.

The two main issues that are motivating the need for this data set are the ESA listing of salmonids and the SMA revisions.

Methods (based on Howes et al 1994)

- Low Tide, Spring Helicopter surveys (1994-2000)
- Collected aerial video imagery with voice tracks by geoscientist and marine ecologist.
- Used video to delineate units on 1:12000 orthophotos.
- Created spatial data and tabular inventory records.

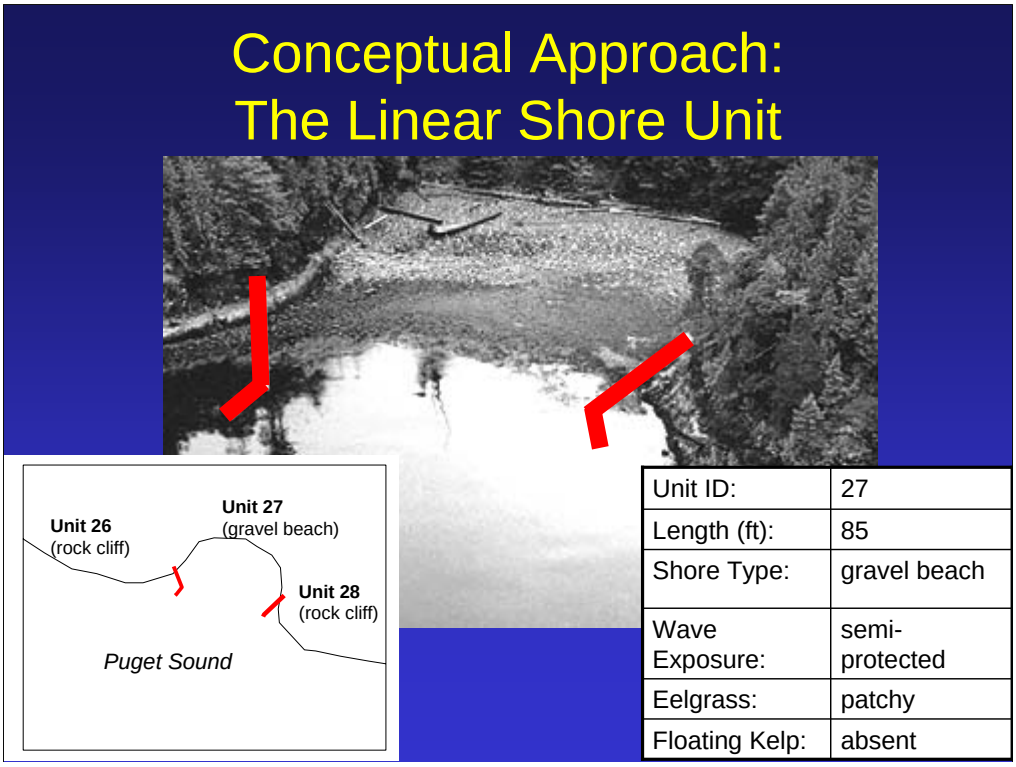
Briefly… This is how it's done…

It's a helicopter survey flown at low tides.The helicopter flies approx. 100 ft offshore @ 300-500 ft elevation and @ 60 mph.

From the helicopter, aerial video imagery is collected with 2 simultaneous – voice tracks by a coastal geomorphologist and marine ecologist.

This is a photo of the geomorphologist/videographer – living life on the edge – hanging out of an open helicopter. The marine ecologist is in the front.

Back in the office, the data is analyzed and turned into a GIS coverage.



The basic concept underlying the SZ inventory is that a shoreline can be divided into smaller pieces called **units**. A unit is a linear segment of shoreline which describes a homogenous stretch of beach… the UNIT is the key element in this database. This concept is simply represented in this slide.

Here unit 27 describes a gravel pocket beach. It's bounded on both sides by rocky cliff… unit 26 to the left & 28 to the right.

Over here-to your right, is a simplified table describing Unit 27 & a morcel of the associated parameters – this gravel beach is 85 feet long, is semi-protected and has patchy eelgrass.

By the way, 85 feet is the shortest length for a unit out of 8736 unit records. The Average length of a unit is .5 mile and the longest unit is 23.7 miles – out on Long Beach.

We like to think of ShoreZone as spatially soft but information rich. Spatially soft because it doesn't tell where exactly where in each unit the item is.

Line, Polygon and Point Data Types

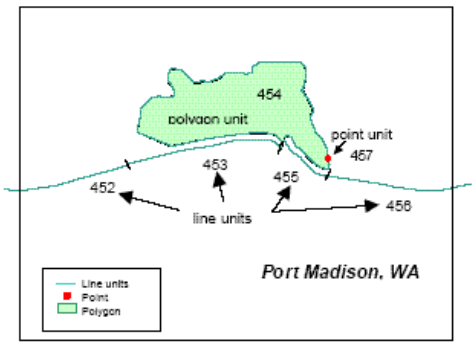
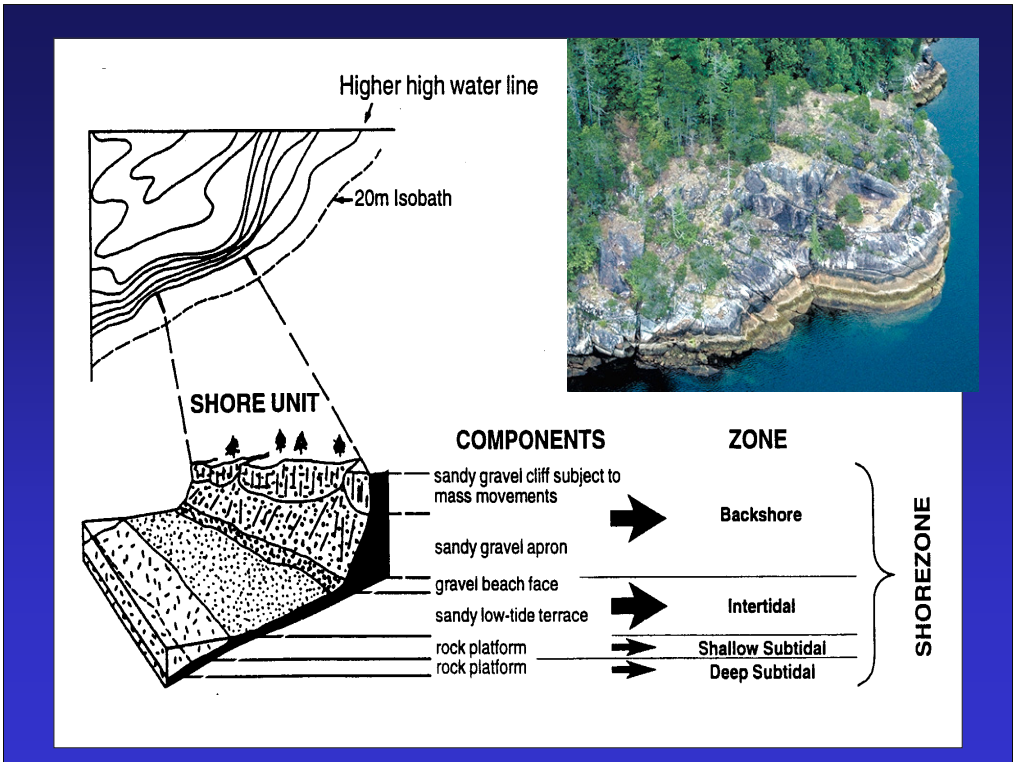


Figure 2 A typical map of shore zone information showing the three types of units.
The map is based on the Ordinary High Water line (OHW) that has been subdivided into line segments (units 452, 453, 455, 456). Points represent small features (unit 457). Polygons represent features with unique spatial characteristics that are not captured by a single line segment (unit 454).



This conceptual diagram shows that each unit is divided into "across shore components." Components correspond to 3 tidal zones – so for each unit there are many across shore components.

These components are not mapped, but are recorded in the Across shore components table.

Across Shore Components

Unit Data

Each spatial record delineates one unit and includes tabular information describing the unit.

One-to-many

Across-Shore Component Data

For each unit, many associated across-shore component records describe the physical and biological features in detail. The location of each across-shore component is first described according to the zone it occurs in (A=supratidal, B=intertidal , C=subtidal). It is possible to have multiple components per zone. Within each zone, each across-shore component is numbered sequentially (i.e., A1, B1, B2, C1).

Line Units

Unit ID	Shore Type	Length (ft)	Wave Exposure
1	Man-made	1460	Semi-protected
2	Sand flat	2106	Protected
3	Cliff w/ gravel & sand beach	1210	Exposed

Across-Shore Components

Xshr ID	Unit ID	Zone	Comp	Form & Material	Biology
1	3	A	1	Steep cliff (bedrock)	Verrucaria Lichen
2	3	B	1	Beach face (pebble, cobble)	Rockweed
3	3	B	2	Beach w/ low tide terrace (sand, boulder)	Barnacles, Mussels, Non-floating kelp
4	3	C	1	Unknown	Eelgrass

Demo of ShoreZone Data

1. Get information on one location using the full inventory shape file and the ‘information’ tool
2. Map the abundance and distribution of resources with easy-to-use themes
3. Characterize an area by summarizing proportion of shoreline with X resource
4. Additional tabular files: across shore components

Usage Guidelines (the fine print…)

- Rule of thumb for determining what features are included: *Could I have seen it from the window of a helicopter traveling at 60 mph and 300 feet above the ground?"*
- The inventory is a valuable regional data set because it surveyed thousands of miles using consistent methods during a relatively short time frame. However, it cannot replace higher resolution techniques or site-specific surveys.

The ShoreZone Inventory is a conservative representation of the actual extent of the resources.

Use the following rule of thumb to determine what features are included: *"Could I have seen the feature from the window of a helicopter traveling at 60 mph and 300 feet above the ground?"*

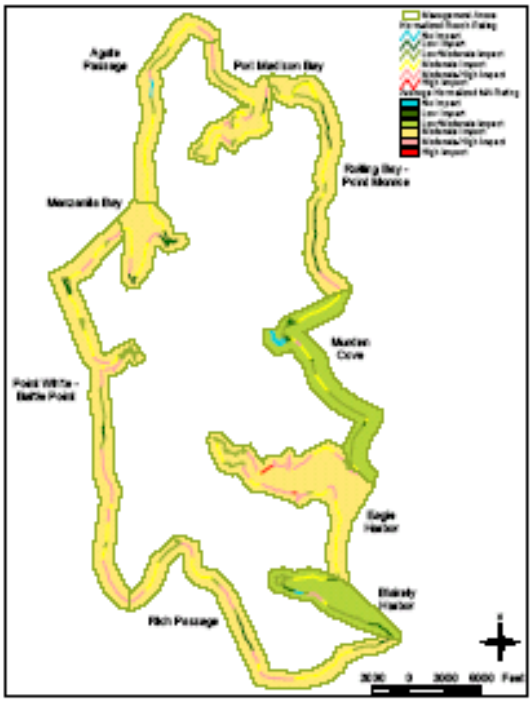
The inventory is a valuable regional data set because it surveyed thousands of miles using consistent methods during a relatively short time frame. However, it cannot replace higher resolution techniques or site-specific surveys.

Elements of Successful Plans That Use ShoreZone

- Explicit rationale or conceptual model for including specific habitat attributes
- Integration with other species and habitat information
- Linkage to management objectives
- Placement in a landscape context
- Acknowledgement of data limitations

Bainbridge Island Nearshore Characterization and Assessment Report

www.ci.bainbridge-isl.wa.us/nearshore-report



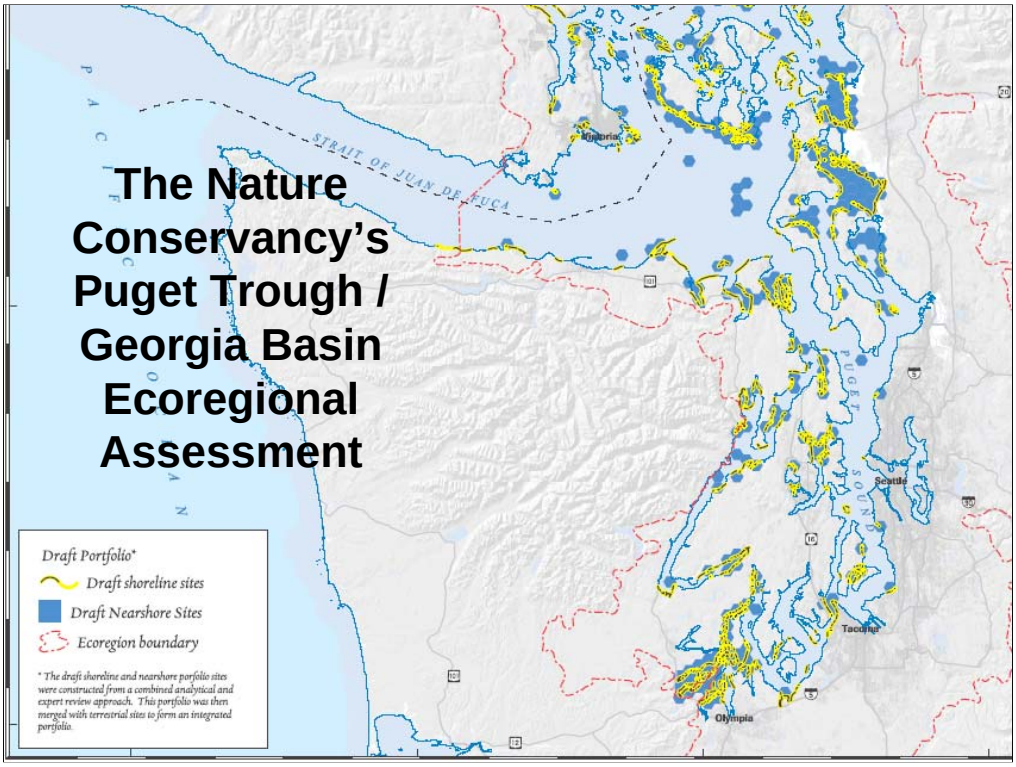

The Nature Conservancy's Puget Trough / Georgia Basin Ecoregional Assessment
STRAIT OF JUAN DE FUCA
PUGET SOUND
Victoria
Seattle
Tacoma
Olympia
Draft Portfolio*
Draft shoreline sites
Draft Nearshore Sites
Ecoregion boundary
* The draft shoreline and nearshore portfolio sites were constructed from a combined analytical and expert review approach. This portfolio was then merged with terrestrial sites to form an integrated portfolio.

Table 2. Summary Inventory Comparison.

	ShoreZone Inventory	Bainbridge Island Inventory	Difference
Shoreline Length	48.59 miles	53.45 miles	-4.86 miles
Shoreline Modification	52.4%	48.5%	3.9%
Overhanging Riparian Vegetation	17.6%	27.1%	-9.5%
Piers/Docks	227	291	-64
Small Moorage Slips (piers/docks only)	1073	967	106
Large Moorage Slips (piers/docks only)	14	14	0
Boat Ramps	32	108	-76

From: Best, P.N. 2004. Bainbridge Island Nearshore Structure Inventory. *In* Proceedings of the 2003 Georgia Basin/Puget Sound Research Conference.

Using ShoreZone Information to meet WA SMP Guidelines

- ShoreZone provides information on physical and biotic resources. How does this relate to ‘ecological function’?
- ShoreZone isn’t detailed enough to detect change over time unless significant change occurs. How does this relate to ‘no net loss’?

Percent of Shoreline with Aquatic Vegetation

Area	Total Miles	Eelgrass	Floating Kelp	Non-floating Kelp	Sargassum
State	3067	37%	11%	31%	18%

Look at what you can do here… Another way to present this data is a simple table which summarizes % of shoreline with other types of submerged aquatic vegetation… statewide.

Here's eelgrass again at 37%…

There's also a fair distribution of other marine veg….(moving along…) Kelp (like eelgrass) is protected in the WACs.

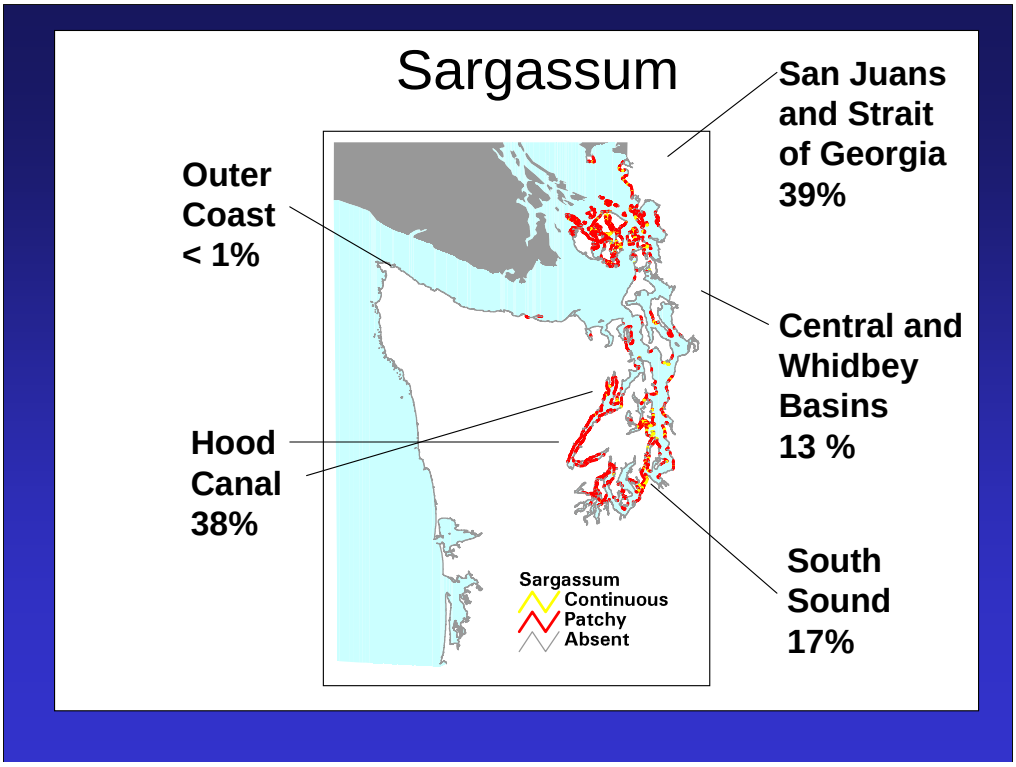
11% Floating kelp which includes two types – bull kelp and giant kelp….
31% Non-floating kelp-

Note the 18% for Sargassum. This is an Exotic species, but it has a higher state-wide presence than floating kelp…That's rather dramatic, considering it was introduced to WA state in the 1940's. What are the implications of that?

While these statewide estimations are useful, it doesn't tell the whole story.

Sargassum muticum

A little diversion- As a marine biologist I need to include a picture of something biological But if you're not familiar with Sargassum…This gives you an idea of what it looks like – It's a brown algae that can grow to 2 meters tall. 2 poses here-one picture standing erect in the water column and one lying down (it doesn't lie down for long).



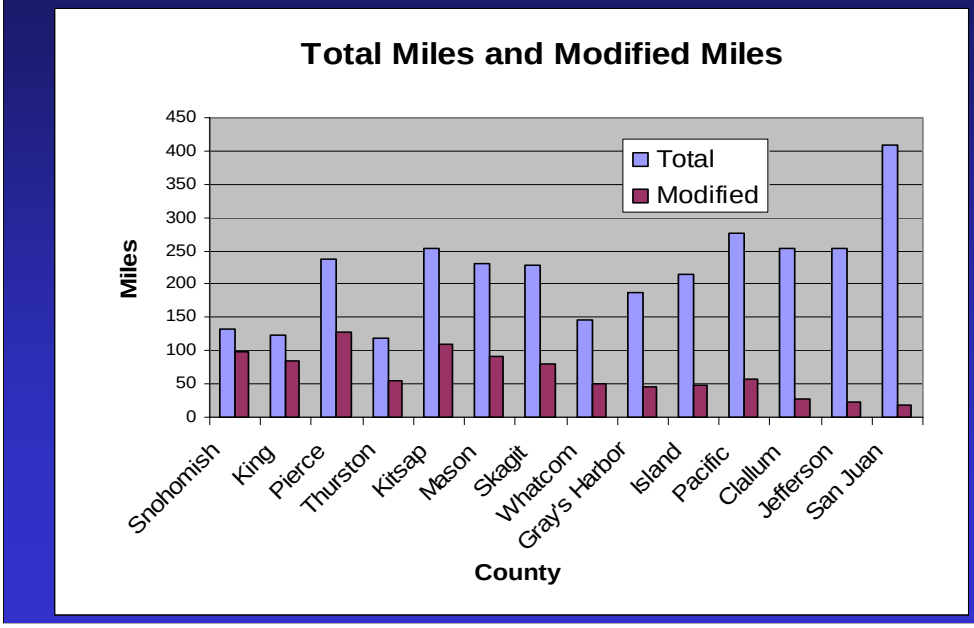
Remember 18% statewide – Compare that to the regional levels. Like you saw with the Eelgrass map, distribution of biological features aren't UNIFORM in our diverse environment – they vary with physical and oceanographic conditions..

SO, along the outer coast less than 1% of the linear shoreline has Sargassum.

In contrast, look at the high % of Sargassum in these 2 regions…more than twice the presence along the shoreline than the statewide 18%… Unfortunately little is known about the ecological implications of this…

At least, now we have a baseline to track if it continues to increase.

Shoreline Modification



This chart summarizes shoreline modification by county – there's increasing interest in producing this kind of information at the local level.

Looking at the bar chart is ranked by the most highly modified Co. on the left - Snohomish and King counties have the highest percentage of shoreline miles modified, about 70%. And San Juan Co. (on the right has the most shoreline, 400 miles, and the least amount of modification, 5%.

Amount of modification is related to development patterns. Snohomish and King Counties have large populations, they saw early development in Washington from agriculture, residential and commercial uses.The counties on the left side of the chart are significantly less populated and developed.

Again,Amount of modification is also related to environmental characteristics. Snohomish and King County have unconsolidated shorelines, which are more prone to shoreline erosion, whereas in San Juan Co., there is a high percentage of stable rocky shoreline – therefore,less need for bulkheading

A little later, Blain will talk about a recent study we did… to determine the % of bulkheading due to single family residents in WA state…surprisingly approx. 55% of the bulkheads are associated with SFR He'll elaborate on the significance of this finding.

Saltwater Shoreline Modification

- 30% of shorelines modified
- 1,237 boat ramps
- 3,578 piers and docks
- 29,809 recreational boat slips

We analyzed the data set for state-wide statistics for shoreline modifcation.

So here they are…30% of the Shoreline has been modified.

Think about it …that means **one** in every **3** feet has been visibily modified or altered. WOW!.

The are also a mind boggling amount of over–water structures.

And note – almost 30,000 recreational boat slips - with 3000 miles of shoreline…That averages out to almost 1000 boat slips per mile.

Carr Inlet Intertidal Habitat

(Percent of shoreline)

Habitats	Biota
Wide sand flat (25%)	Eelgrass (23%)
Narrow sand and gravel beach (23%)	Salt marsh (16%)
Organics/fines (19%)	Green algae (14%)
Narrow sand beach (10%)	Non-floating kelp (3%)
Wide sand and gravel flat (10%)	Dense oysters (5%)
Wide mud flat (7%)	Sand dollar beds (<1%)

This table characterizes the % of habitats in Carr Inlet, (this is a large inlet in Pierce Co. - west of the Tacoma Narrows).

A first step in many research and management projects is to characterize the natural resources in an area. This data can provide a regional summary of the abundance and distribution of habitat types.

(Looking at our table)…(point).. note.. Habitat types are summarized on the left and biota on the right…with the most abundant habitat types on the top.